

**Finding Impact Craters with Landsat**

**◀ Lesson Plan ▶**

**Step 1** . Use students' interest in the highly dramatic, explosive to introduce the activity.

Show students an aerial photograph of **Barringer Meteor Crater** (also known as "Meteor Crater", and located in Arizona). Tell them this landform is about 1300 meters (0.8 mile) in diameter and 174 meters (570 ft) deep. Ask them, what do you think could have made a hole this big in the land? Discuss as a class.

Show an artist's rendering of an impact event. Two are provided.

1. "One Minute After the End of the Cretaceous" by William K. Hartmann [**"Chicxulub #3 of 5 – 100 dpi.jpg"**]

*Please be aware* that anyone reproducing this painting for uses other than this classroom activity, "Finding Impact Craters with Landsat" must contact William K. Hartmann for his permission, at: <hartmann@psi.edu> or by using information at this URL: <http://www.lpi.usra.edu/publications/books/CB-954/CB-954.intro.html>

2. **Impact Painting by Don Davis** (Use hotlink or go to:  
< <http://www.donaldedavis.com/PARTS/K-TNASA.jpg> >

Tell students that many objects much smaller than a planet orbit the Sun, and sometimes the Earth's path crosses theirs. When that happens, there is an impact event of enormous force, with profound effects on rocks and soil, atmosphere, water, and living things.

Ask students to imagine hitting a dust particle or a fleck of paint in the air with their finger. They will understand that such a collision would not leave any lasting mark. Tell them that NASA engineers working on the Space Shuttle have found that even tiny flakes of paint floating in space (from earlier missions) can make craters one centimeter in diameter in Space Shuttle windows when they hit them, because of the speed of impact. Emphasize that there is a lot of energy in an object traveling fast. It has been calculated that the energy required to produce the Barringer crater was equivalent to the explosion of 15 million tonnes of TNT.

Have a discussion about what students may already know about impact events. Ask students if any of them have visited Barringer Meteor Crater. Students who have done so can describe their experience.

*Do the following either in the classroom or as homework the night before you wish to conduct the bulk of the lesson:*

Distribute the Student Worksheet for Step 1, "When an Extraterrestrial Object Hits the Earth".

On the worksheet, students read a short description of what happens during an impact event. Based on that reading and on their existing knowledge, they describe the effects such an event might have on the land, air, and living things, and evidence of these effects that might remain for thousands or millions of years.

*In the classroom:*

**Step 2.** Distribute Student Reading for Step 2: *Known Effects of Impact Events*, and have students read quietly alone or aloud together.

**Step 3.** Show either of the following, both of which are provided with this activity:

(a) the movie, "Iturralde Movie" [\[Laura please hotlink\]](#)

or

(b) the series of three still images from the movie, "Iturralde Stills", which is provided with this activity. [\[Laura please hotlink this too. Let's talk about how best to do this. I can make still images from the movie or let you.\]](#)

Explain to students that the movie is made of Landsat images of a location in Bolivia, made of the same data but displayed in different ways by NASA scientists as the movie progresses. The movie and the series of still images taken from it show very clearly how satellite technology helps us see landforms hidden in the Earth's surface that we cannot see with our eyes alone.

**Step 4.** Organize students in small groups (of three to five students). Distribute the following:

(1) One set of seven satellite images to each group

(2) One copy for each student of the Student Worksheet Sheet for Step 4:  
*Describing Satellite Images of Possible Impact Craters*

Given what students know about the evidence left by impacts, ask student groups to determine whether or not the landforms in all seven of the images appear to be impact craters.

Guidance questions are provided on the Student Worksheet.

Monitor the student groups as they discuss their analyses of the satellite images.

1. Make sure students understand that they should come to agreement as a group about their satellite images based on their analysis of the evidence in the images.
2. The Student Worksheet provides instructions about sharing their thoughts about the evidence before coming to agreement as a group. As groups discuss their analyses of the images, make sure they are discussing the evidence constructively with each other.
3. If students do not follow these instructions in the worksheet, direct them to choose one or two of the satellite images they find most interesting to interpret for the class, and to designate a spokesperson for the group.

**Step 5.** Have each spokesperson interpret the group's images. Make sure that all of the images in the set provided are covered in the class discussion.

Whether or not students believe each image shows an impact crater, their spokesperson must explain their group's thinking clearly and convincingly.

For positive identifications of the landforms as needed, use the *Teacher Reference for Step 5: The Landforms Identified*.

*Either in the classroom or as homework:*

**Step 6.** Distribute Student Worksheet for Step 6: *Questions You Would Ask on a Field Expedition to a Possible Impact Crater*

Ask students to write a set of questions for researchers going on a field expedition to an unidentified landform. The questions should serve well as guidance to determine whether or not the landform could be positively identified as an impact crater.